SENATE BILL 1505

ENVIRONMENTAL STANDARDS FOR HYDROGEN PRODUCTION

WORKSHOP

Sacramento: April 7, 2008

Training Room 1

Cal/EPA Headquarters

Workshop Agenda

Part One

- ☑ Bill Recap
- ☑ Applicability
- ☑ Reporting Requirements
- ☑ Exemptions

Part Two

- ☑ Emissions sources
- ☑ Greenhouse Gas Emissions
- ☑ NOx and ROG Emissions
- ☑ Toxic Air Contaminant Emissions

Part Three

- ☑ Renewable Resources
- ☑ Other Concerns
- ☑ Timeline
- ☑ Next Steps

CALIFORNIA HYDROGEN HIGHWAY NETWORK

Part One

- Bill Recap
- Applicability
- Reporting
- Exemptions

Senate Bill 1505 Overview

Directs ARB to develop regulation for transportation hydrogen

Emission reduction requirement (relative to gasoline)

- 50% reduction of NOx and ROG (WTT),
- 30% reduction of greenhouse gas (GHG) (WTW),
- No increase in toxic air contaminants WTT

Energy source requirement

- 33.3% renewable hydrogen

Threshold requirement

- 3,500 metric tons/year (3,500,000 kg/yr)

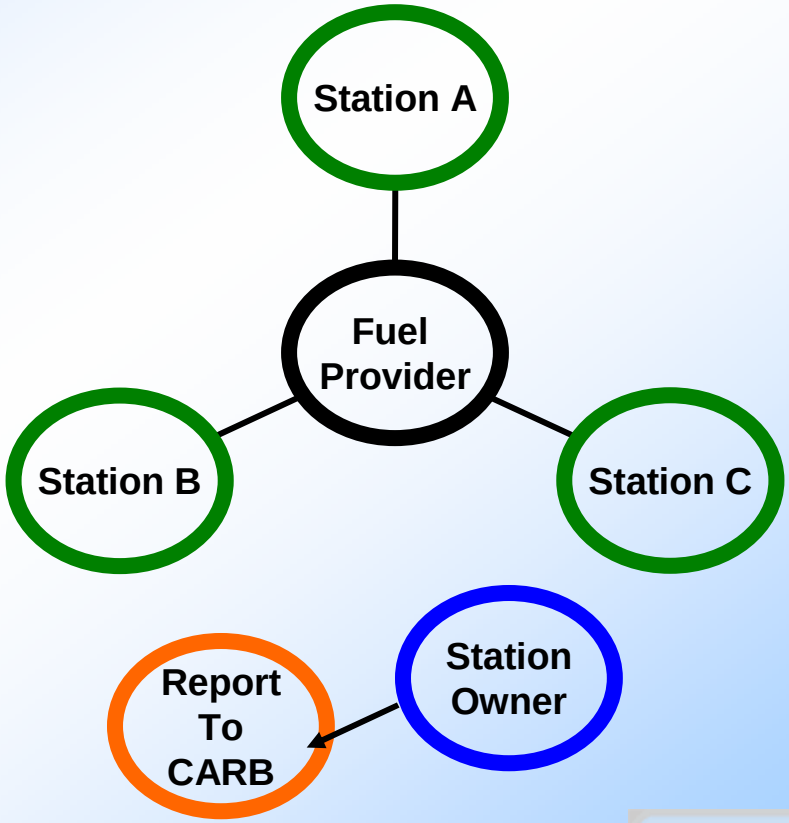
Applicability

Who does this regulation apply to?

- Dispensers of hydrogen within the state
  - Retail fueling stations
  - Non-retail fueling stations
  - Fleets (e.g. Bus fleets, Utility fleets)
  - Small demonstrations or research stations
  - Off-road fleets (e.g. Forklifts)

Reporting: Who reports

- Fueling station owner will be the responsible party
- If a company owns multiple stations?
  - one report per station



Reporting: General Information

All stations (pre-threshold)

Production Method & Amount dispensed (kg)

1. **Feedstock (natural gas, biogas, water, etc)**
2. **Production process (SMR, electrolysis, etc)**
3. **Delivery mode (Truck w/LH2, CH2, Pipeline, none)**
4. **Mass dispensed w/accuracy (kilograms)**

Reporting: Environmental Requirements

- Pre threshold
  - Stations awarded state funding after adoption of regulation
- Post threshold (3,500 metric tons)
  - All stations
    - Regulation may not apply to all stations but they must report

Reporting: Environmental Information

1. **Renewable requirement and how it is met (kWh or kilograms of H2)**
2. **Emissions of**
   i. **NOx plus ROG (WTT) (g/GJ)**
   ii. **GHG (WTW) (g/mi)**
   iii. **TAC (WTT) (g/GJ)**

Reporting: Format

When to report?

- Quarterly
- Begins 6 months after regulation adoption
- Post-threshold reporting begins 1 year after threshold reached

How to report?

- Electronic on-line
- Downloadable form, either electronic or hard mail submission
- Goal: 1-2 page reporting form
- We'll provide tools to determine emissions and renewables

Exemptions

Staff exemption suggestions

1. Reduce renewable requirement by 10% to 23.3%
   - Allows transition to 33.3% renewable as technologies advance and mature
   - Lowers barriers on early stations to demonstrate compliance
2. Exempt transit agencies
   - Transit agencies required to purchase alt fuel vehicles already, therefore they must also provide fuel
3. Exempt small state funded stations from emissions and renewable for five years
   - Must be less than 10% of all hydrogen in the state
   - Stations need now to support vehicle deployments

Part Two

- Emission Sources
- Greenhouse Gas Emissions
- NOx and ROG Emissions
- Toxic Air Contaminant Emissions

Emissions occurrences

- The emissions from hydrogen production will be based on the following

WTT

Feedstock Recovery

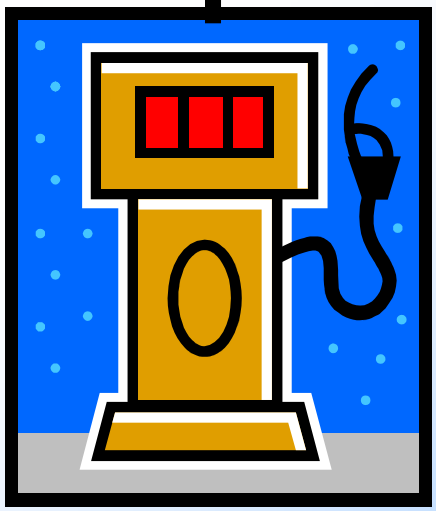
Feedstock transport

Feedstock conversion

Hydrogen compression

Hydrogen delivery

Hydrogen dispensing



TTW

Vehicle use: Hydrogen FCV (50 mi/kg) ARB will review this with certification data

Marginal Emissions

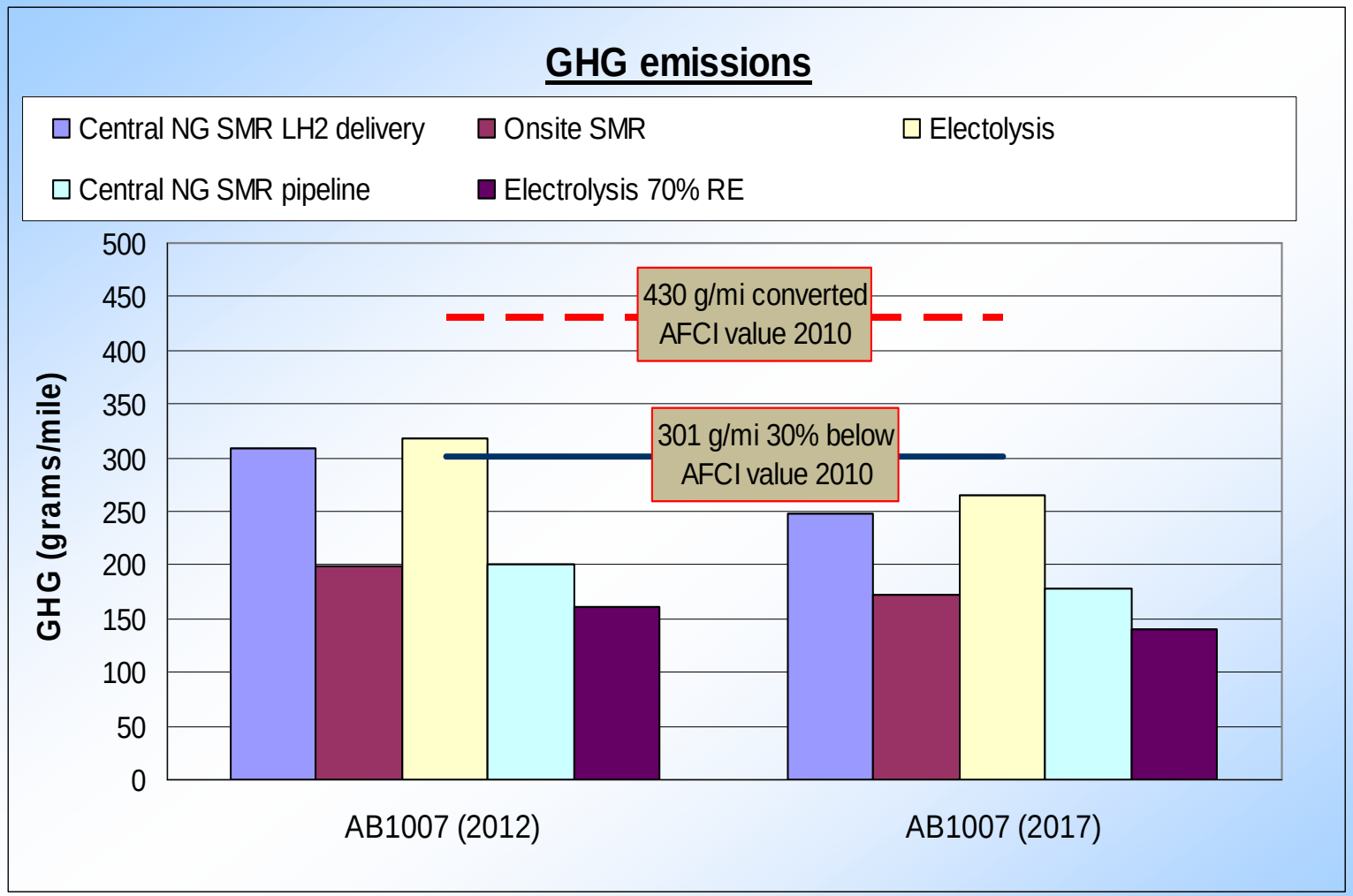
- The NOx, ROG and TAC emissions from hydrogen production will be based on the following:
  - Petroleum demand met by importing finished product
  - Electricity from natural gas combined cycle power plants (80%) and renewable electricity (20%)
  - New stationary sources use BACT and all NOx and ROG emissions are offset
  - Fuel transport vehicles meet CARB requirements
  - Natural gas originates from outside California

CALIFORNIA HYDROGEN HIGHWAY NETWORK

Greenhouse Gases

- Baseline based on the Low Carbon Fuel Standard - Average Fuel Carbon Intensity (AFCI) value for gasoline.
  - Current value 92 gCO_2/MJ
  - If LCFS adopts a different value, the new value will be incorporated
  - Must convert 92 gCO_2/MJ to g/mi. Conversion factor based on State Alternative Fuel Plan (SAFP)
    - MJ/Gal and mi/Gal
  - Result: 430 g/mi for gasoline baseline
  - Hydrogen production requirement for GHG must be 30% less: <u>301 gCO_2/mi GHG</u>

Greenhouse Gases



Part Two: GHG

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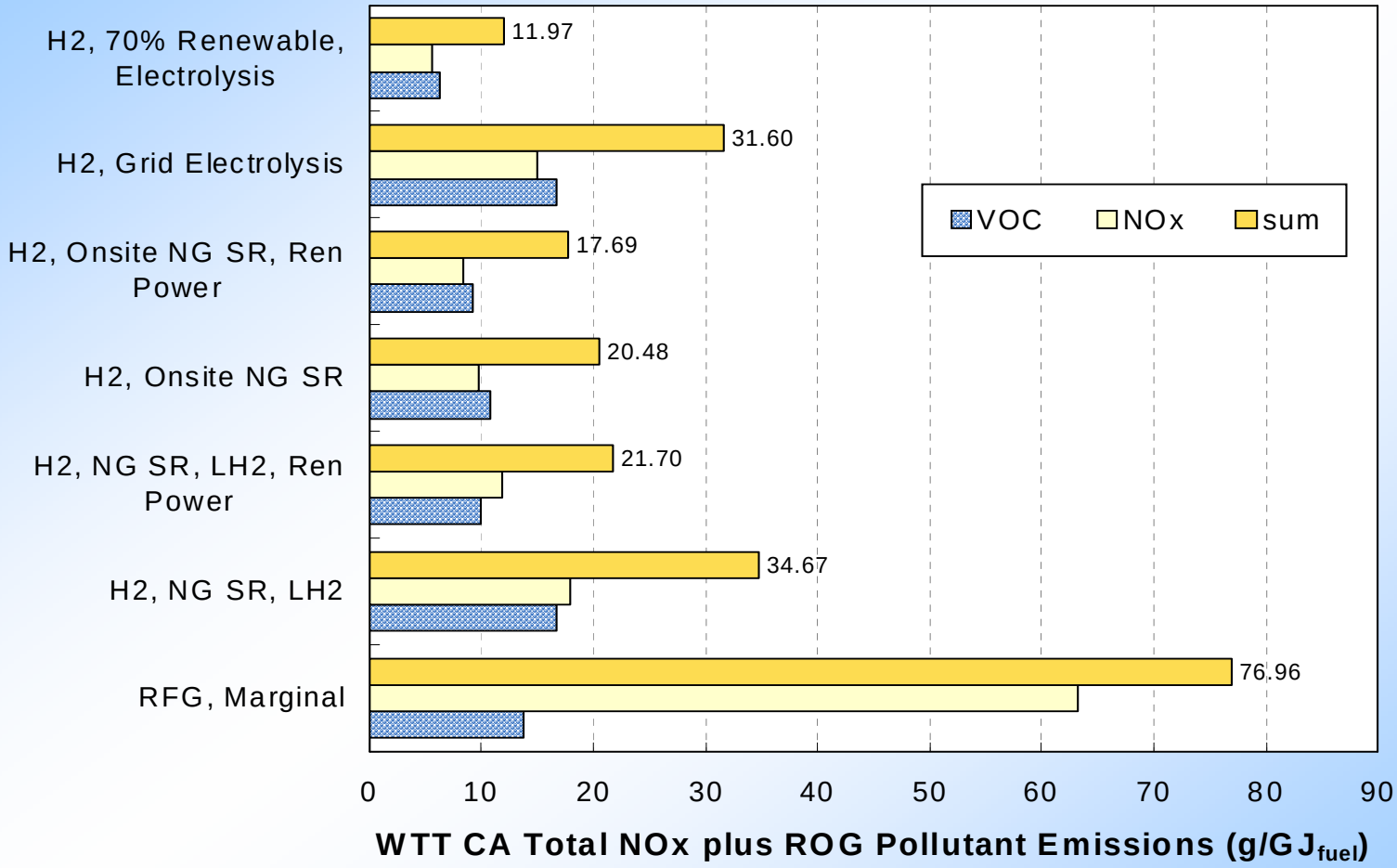
NOx plus ROG

State Alternative Fuels Plan (AB 1007) - Fuel Cycle Emissions Factors (g/GJ fuel)



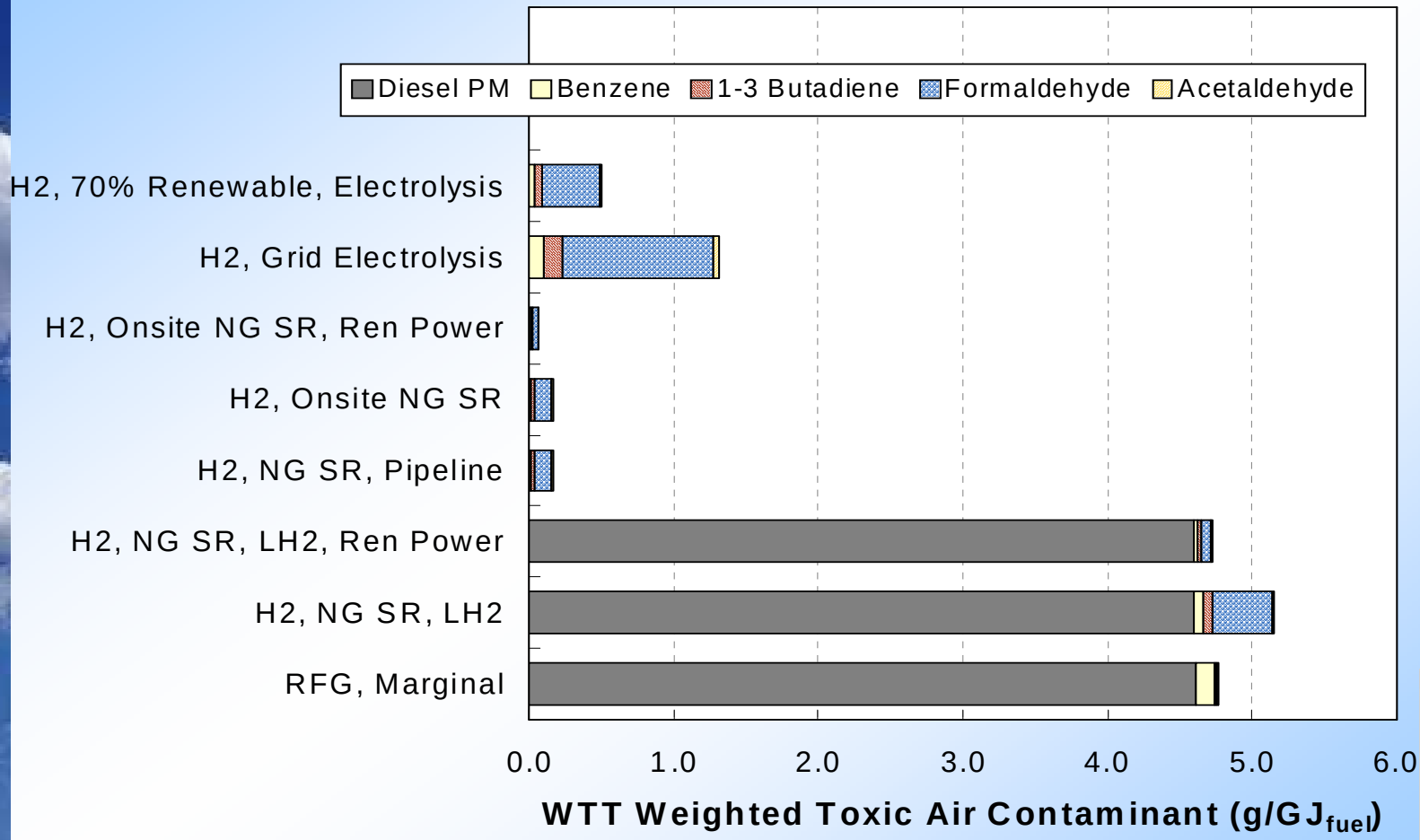
Part Two: Baseline Assumptions

CALIFORNIA HYDROGEN HIGHWAY NETWORK

Toxic Air Contaminants

- "Relevant TACs" include:
  - Acetaldehyde
  - Benzene
  - 1,3-butadiene
  - Formaldehyde
  - Diesel particulate matter
- Will compare gasoline baseline to hydrogen pathway using total relevant TACs normalized to formaldehyde

Toxic Air Contaminants WTT



Part Two: Baseline Assumptions

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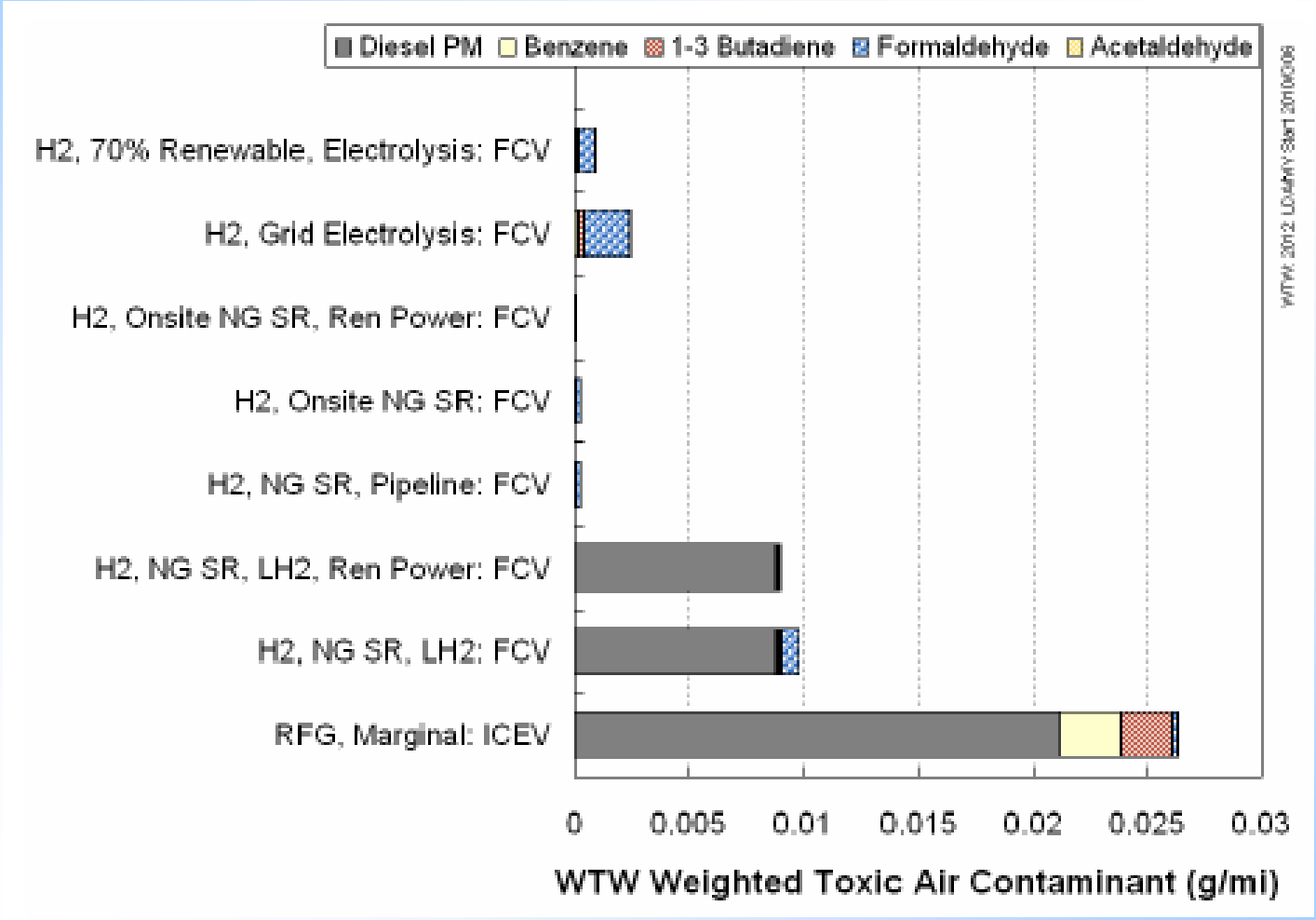
Toxic Air Contaminants WTW



Part Two: Baseline Assumptions

CALIFORNIA HYDROGEN HIGHWAY NETWORK

Part Three

- Eligible Renewables
- Concerns
- Timeline

Eligible Renewable Resources

- Supports movement away from non-renewable transportation fuels
- Legislation requires that 33.3% of hydrogen produced for transportation be made from "eligible renewable energy resources" as defined in PUC 399.12
  - Electricity produced from an "in-state renewable electricity generating facility" defined in PRC 25741
- No double counting

Eligible Renewable Resources

- Staff proposes to broaden the definition to include:
  - Renewable electricity AND
  - Renewable feedstocks listed in PRC 25741(b)(1).
- Supports use of renewable feedstocks in existing H2 production processes
- Supports unique opportunities for R&D and growth

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Points of Clarification

- Hydrogen produced for transportation includes purification, compression, etc.
- Statewide compliance target
  - State-funded stations assessed in aggregate
  - Post threshold non-state funded stations assessed by individual provider's aggregate

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What is Included in the 33.3%?

- Count all energy inputs
  - feedstock (NG, biogas, biomass, electricity)
  - production/reformation and purification
  - compression or liquefaction
  - storage and dispensing
- Convert to kWh/kg H2 and find 33.3%, then find total (in kWh) needed based on amount dispensed
- Renewable energy credits (RECs) must be verified through a tracking system under development by CEC.

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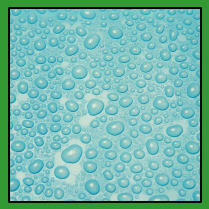
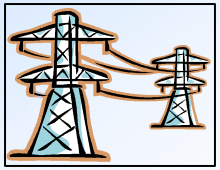
Non-Electrical

Water



Electrical

Non-Renewable



2,880 kwhr

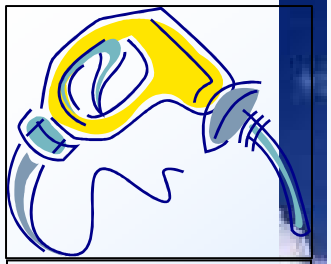
33% Renewable

1,440 kwhr

4,320 kWhr

Electrolysis processes & Components

Electrolyzer
Cooling fans & Blowers
Controller
H2 Compression
Storage
Dispensing



60 kg of 10,000 PSI Hydrogen output **33% Renewable**

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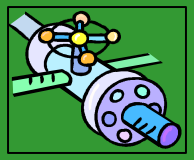
Non-Electrical

Natural Gas

5.87 mmBtu / 1,720 kwhr

Renewable Biogas

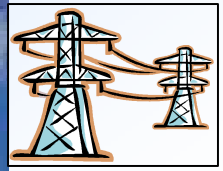


3.96 mmBtu / 1,160 kwhr

9.8 mmBtu 2880 kWhr

Electrical

Non-Renewable

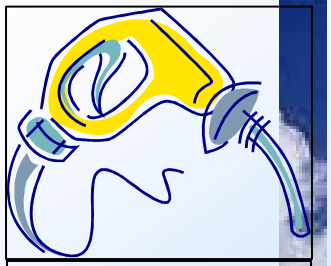


600 kWhr

600 kWhr

SMR Processes & Components

Steam Methane Reformer
Natural Gas compressor
Cooling fans & Blowers
Controller
PSA motor
H2 Compression
Storage
Dispensing



60 kg of 10,000 PSI Hydrogen output **33% Renewable**

CALIFORNIA HYDROGEN HIGHWAY NETWORK

Other Concerns

- ✓ Can hydrogen producers trade renewables (energy or hydrogen) among themselves?
- ✓ Tracking and assessing impact of home refuelers
- ✓ Renewables – restricted or broader definition?

Timeline

- April 15, 2008
  - Comments to staff
- May 9, 2008
  - Release ISOR for 45 day public comment period
- June 26, 2008
  - (ISOR) presented to the Board for approval

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